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Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	6 July 1994	Summary 01 June 93 - 31 May 94

4. TITLE AND SUBTITLE
Thermoacoustic Pin Stacks

5. FUNDING NUMBERS
PE 61153N
G N0001493WR24062
N0001494WR23044
TA 3126978

6. AUTHOR(S)
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8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Office of Naval Research
ONR 331
800 North Quincy Street
Arlington, VA 22217-5660

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
ONR Annual Summary Report

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release:
Distribution unlimited

13. ABSTRACT *(Maximum 200 words)*

The construction and testing of a new stack geometry for thermoacoustic engines, called a "pin stack," has been started. The stack is at the heart of a class of heat engines that use sound to deliver refrigeration, or use a temperature difference to generate sound. Calculations show that the pin stack should make useful improvements in engine efficiency. About 2000 wires will be hand sewn in a hexagonal lattice beteen the hot and cold heat exchangers in a sound source using low pressure neon gas between 300 K and 77 K.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Thermoacoustics, refrigeration, acoustic source, heat pump	2
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	

ONR Annual Summary Report
Thermoacoustic Pin Stacks
N0001493WR24062, N0001494WR23044
July 1994
Robert M. Keolian, PI

Submitted to: DR LOGAN E HARGROVE ONR 331
OFFICE OF NAVAL RESEARCH
800 NORTH QUINCY STREET
ARLINGTON VA 2217-5660

Description of Project:

The primary objective of this research is to construct and test "pin stacks." It is hoped that this new stack geometry will improve the efficiency of thermoacoustically based refrigerators, heat pumps and prime movers. Secondary objectives include the exploration of the desirability and practicality of fractal heat exchanger designs and of parametric sound sources.

Approaches Taken:

A comparison of the pin stack geometry with the conventional rolled geometry will be made in a modular prime mover test rig which uses low pressure neon gas straddling room and liquid nitrogen temperatures. The stack will be constructed by hand sewing a wire back and forth about 2000 times between the hot and cold heat exchangers. A small acoustic driver will be added to the rig to allow us to measure the quality factor Q below onset as a function of neon pressure. The performance of the pin stack will also be compared to the theory for pin stacks, developed by Greg Swift of Los Alamos National Laboratory, as incorporated in the program DeltaE.

Accomplishments Completed:

The program DeltaE has been run with the conventional rolled stack geometry used in previous experiments on this rig, in order to make sure that we can get the program to agree with experiment. Also, a series of DeltaE runs using pin stacks has been made to increase our understanding of pin stacks and to optimize the test stack's dimensions. A wire size of 75 microns with a spacing of 750 microns, in a nearly hexagonal lattice pattern fitting nicely on the heat exchangers, has been selected. Parts are now being machined in preparation for the sewing of the stack.

The secondary objectives of fractal heat exchangers and parametric drives have not been pursued extensively.

Students Associated with Grant:

LT F. Scott Nessler, USN, is conducting his MS. thesis work on this project.

OFFICE OF NAVAL RESEARCH
PUBLICATION/PATENTS/PRESENTATION/HONORS REPORT
for

1 June 93 through 31 May 94

R&T Number: 3126978

Contract/Grant Number: N0001493WR24062 and N0001494WR23044

Contract/Grant Title: Theroacoustic Pin Stacks

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a. Number of Papers Submitted to Referred Journal but not yet published: 0

b. Number of Papers Published in Referred Journals: 0
(list attached)

c. Number of Books or Chapters Submitted but not yet Published: 0

d. Number of Books or Chapters Published: 0
(list attached)

e. Number of Printed Technical Report & Non-Referred Papers: 0
(list attached)

f. Number of Patents Filed: 0

g. Number of Patents Granted: 0
(list attached)

h. Number of Invited Presentations at Workshops or Prof. Society Meetings: 0

i. Number of Presentation at Workshop or Prof. Society Meetings: 0

j. Honors/Awards/Prizes for Contract/Grant Employees:
(list attached, this might include Scientific Soc. Awards/Offices, Promotions, Faculty Award/Offices etc.) 2

k. Total number of Graduate Students and Post-Docs Supported at least 25%, this year on this contract,grant:

Grad Students 1 and Post Docs 0

How many of each are females or minorities? (These 6 numbers are for ONR's EEO/Minority Reports; minorities include Blacks, Aleuts Amindians, etc and those of Hispanic or Asian extraction/nationality. This Asians are singled out to facilitate meeting the varying report semantics re "under-represented")

- Grad Student Female 0
- Grad Student Minority 0
- Grad Student Asian e/n 0
- Post-Doc Female 0
- Post-Doc Minority 0
- Post-Doc Asian e/n 0

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